

BEFORE THE  
**Federal Communications Commission**  
WASHINGTON, D.C. 20554

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JUL 19 1999

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

In the Matter of )  
 )  
Service Rules for the 746-764 and )  
776-794 MHz Bands, and )  
Revisions to Part 27 of the Commission's Rules )

WT Docket No. 99-168

To: The Commission:

**COMMENTS OF THE U.S. GPS INDUSTRY COUNCIL**

The U.S. GPS Industry Council ("the Council"), by its attorneys and pursuant to Sections 1.415 and 1.419 of the Commission's rules,<sup>1</sup> hereby comments on the Commission's notice of proposed rule making in the above-captioned proceeding.<sup>2</sup> In this proceeding the Commission is seeking, among other things, to adopt out-of-band emission ("OOBE") standards for general applicability for emissions falling within the Global Navigation Satellite Systems ("GNSS") frequency bands -- *i.e.*, the band 1559-1610 MHz -- from transmissions of systems operating in the 776-794 MHz bands.<sup>3</sup>

**I. STATEMENT OF INTEREST**

The U.S. GPS Industry Council is a non-profit 501(c)(6) industry trade association whose mission is to be an information resource to the Government, the media, and the public on the Global Positioning System ("GPS"). The Council's purpose is to promote sound policies for the development of commercial markets in civilian application, while preserving the military advantages of GPS. Current membership includes the principal U.S. manufacturers of GPS

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<sup>1</sup> 47 C.F.R. §§ 1.415 and 1.419.

<sup>2</sup> See *Service Rules for the 746-764 and 779-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, Notice of Proposed Rule Making*, WT Docket No. 99-168, slip op. (FCC 99-97) (released June 3, 1999) ("*NPRM*").

<sup>3</sup> See *NPRM*, FCC 99-97, slip op. at 34 (¶ 73), 36 (¶ 76).

equipment – *e.g.*, Boeing, Honeywell, Magellan/Ashtech, Rockwell International, and Trimble Navigation.

The Council represents a significant sampling of the hundreds of manufacturers of GPS equipment and the millions of users of GPS signals. On behalf of its members, many of whom are engaged in activities with safety-of-life implications, the Council is extremely concerned that if the Commission were to adopt its proposed emission standards without considering all the operational and technical variations, it would lead to the loss of GPS signal reception or errors in position or time accuracy. Either of these consequences is intolerable for a safety-of-life service.

## II. DISCUSSION

In its *NPRM*, the Commission committed to consider the unique requirements of the GPS.<sup>4</sup> Unfortunately, the Council must conclude that the Commission, which has proposed to adopt emission standards that are based on the emission limits recommended by the National Telecommunications and Information Administration (“NTIA”) for use in connection with mobile earth terminals of mobile-satellite service (“MSS”) systems operating in the 1-3 GHz band, has failed to fulfill its commitment to the RNSS and GPS.<sup>5</sup>

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<sup>4</sup> See *id.* at 36 (¶ 76). The GPS will be the United States component of the GNSS. GPS utilizes the Radionavigation-Satellite Service (“RNSS”) (space-to-Earth) allocation from 1559 to 1610 MHz on a primary basis. In this regard, the Council points out the strong presidential and congressional interests in protecting the availability of GPS. See *id.* at 35 (¶ 74).

<sup>5</sup> The NTIA-recommended OOB levels are –70 dBW/MHz for wideband emissions and –80 dBW/MHz for narrowband emissions for certain portions of the GPS band. The Council maintains that, irrespective of the levels, the full spectrum covered by the GPS signal must be protected.

The rationale for the Commission's proposal to adopt the NTIA OOB standards for systems operating in the 776-794 MHz band appears to be that the Commission also proposed the same standards in the *Public Safety Spectrum Second Notice*<sup>6</sup> and the *GMPCS MoU NPRM*<sup>7</sup> proceedings.<sup>8</sup> But there is no showing that the OOB limits proposed in those proceedings would be sufficient to protect GPS receivers from second harmonic emissions from systems operating at 776-794 MHz.

Instead, in the instant proceeding, the Commission continues to propose the NTIA levels to protect GPS receivers from different types of services than the service for which those levels were developed without providing any well-founded analysis or showing. This approach is the flaw in the Commission's proposal. The NTIA levels were developed for a particular aviation scenario operating at a different frequency band than the systems at issue here. In fact, the NTIA

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<sup>6</sup> *Development of Operational, Technical and Spectrum Requirements For Meeting Federal, State and Local Public Safety Agency Communications Requirements Through the Year 2010; Establishment of Rules and Requirements of Priority Access Service*, WT Docket No. 96-86, Second Notice of Proposed Rule Making, 12 FCC Rcd 17706 (1997) ("*Public Safety Spectrum Second Notice*").

<sup>7</sup> *Amendment of Parts 2 and 25 to Implement the Global Mobile Personal Communications by Satellite ("GMPCS") Memorandum of Understanding and Arrangements; Petition of the National Telecommunications and Information Administration to Amend Part 25 of the Commission's Rules to Establish Emissions Limits for Mobile and Portable Earth Stations Operating in the 1610-1660.5 MHz Band*, Notice of Proposed Rule Making, IB Docket No. 99-67 (RM No. 9165) (FCC 99-37), slip op. (released March 5, 1999) ("*GMPCS MoU NPRM*").

<sup>8</sup> See NPRM, FCC 99-97, slip op. at 34 (¶ 73), 37 (¶ 77).

levels can only protect GPS receivers under one set of circumstances.<sup>9</sup> If the Commission were to establish the proposed NTIA levels of -70/-80 dBW/MHz for different types of services, each one of those services would endanger the availability of GPS by itself by raising the noise floor above the level that GPS receivers can operate. Even worse, the cumulative effect from all services operating at emissions of -70/-80 dBW/MHz would be devastating for critical safety-of-life GPS applications.

In its recently-filed comments on the Commission's *GMPCS MoU NPRM* proceeding, where the Commission initially proposed to adopt the NTIA-recommended emission levels in the GPS band,<sup>10</sup> the Council provided a detailed technical assessment of the impact of out-of-band emissions at the NTIA levels on GPS receivers.<sup>11</sup> The Council showed that out-of-band emissions into the GPS band at the levels specified by NTIA and proposed by the Commission in the *NPRM* would have a devastating effect on the ability of GPS receivers to acquire and track GPS satellites.<sup>12</sup> It also asserted that the particular symbiotic relationship that

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<sup>9</sup> In its *GMPCS MoU* Comments, the Council reiterated that the out-of-band emission levels proposed by NTIA were developed for a very specific interference scenario -- *i.e.*, where there was a 100 foot separation between the GPS receiver and the MSS terminal; where the GPS antenna was located on the top of an airplane fuselage and pointed up toward the satellites; and where the MSS terminal is a single, ground-based, omnidirectional transmitter. *See* Comments of the U.S. GPS Industry Council in IB Docket No. 99-67 (RM No. 9165) at 5 (filed June 21, 1999) ("Council GMPCS MoU Comments") (citing the "Assessment of Radio Frequency Interference Relevant to the GNSS," Document No. RTCA/DO-235 (January 27, 1997)). The Council explained that the NTIA OOB levels were not intended to be applied for the protection of GPS receivers used in non-aeronautical scenarios or even in other aeronautical scenarios, and there is no proof whatsoever that the NTIA criteria are effective in situations where all three of the conditions above do not exist. *See id.* at 18-19.

<sup>10</sup> *See GMPCS MoU NPRM*, FCC 99-37, slip op. at 26-27 (¶¶ 61-62).

<sup>11</sup> *See* Council GMPCS MoU Comments at 13-15.

<sup>12</sup> *See* Council GMPCS MoU Comments at 15.

exists between GPS and the 1-3 GHz MSS services permits the adoption of the final NTIA OOB levels with respect exclusively to OOB from MSS mobile earth terminals operating in the 1-3 GHz bands.<sup>13</sup> Finally, and most significantly, the Council emphasized that OOB from any other emitters has to be studied and analyzed on a case-by-case basis.<sup>14</sup>

In this last regard, and citing the results of actual studies, the Council established in its Comments on the *GMPCS MoU NPRM* proceeding that the -70 dBW/MHz level is clearly not a protection criterion for GPS.<sup>15</sup> The Council, recognizing the desirability of a threshold, also showed that the only default level that can safely be established at this point in time is a wideband OOB threshold limit of -100 dBW/MHz.<sup>16</sup> This is the "default" level that out-of-band emissions from transmission systems operating in the 776-794 MHz bands must comply with to protect the millions of GPS safety-of-life applications, absent case-by-case independent studies.<sup>17</sup>

The Council's Comments in response to the *GMPCS MoU NPRM* pertain directly to the instant proceeding – which is premised on the same NTIA recommendation for OOB into the GPS band. As a result of this direct nexus, the Council is attaching a copy of its comments in

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<sup>13</sup> See *id.* at 2-3, 7. The United States has adopted a firm position in the relevant Working Parties of the International Telecommunication Union ("ITU") to the effect that an OOB level of -70 dBW/MHz in the 1559-1605 MHz band for OOB from 1-3 GHz MSS mobile earth terminals may not be applied to any emitters other than MSS METs associated with MSS systems in the 1-3 GHz range unless studies have successfully been completed that address critical subjects including interservice and intraservice aggregate interference levels, the impact of harmonic emissions, separation distances, and shielding. See, e.g., U.S. Contribution to April 1999 Meeting of ITU-R Working Party 8D (Document 8D/210, 4 March 1999); ITU-R Recommendation M.1343.

<sup>14</sup> See *GMPCS MoU Comments* at 2.

<sup>15</sup> See *id.* at 14-15.

<sup>16</sup> See *id.* at 16, 27-29.

<sup>17</sup> See *id.* at 2.

the *GMPCS MoU* proceeding to its instant Comments (*see* Attachment 1 hereto), and hereby incorporates them in full by reference, in order that its *GMPCS MoU* comments and the proposals and policy recommendations advanced therein may form an integral part of the record of the instant proceeding.

As it did in the *GMPCS MOU* proceeding,<sup>18</sup> the Council emphasizes here that the U.S. has made an unequivocal and strong commitment to the “continuous availability of GPS.”<sup>19</sup> GPS has never been defined as, or limited to, an aeronautical service only. As the Commission recognizes, even GNSS is not limited to aeronautical service.<sup>20</sup> Consequently, the instant *NPRM* provides an important regulatory opportunity to faithfully carry out the intent of law and policy to protect the broad range of millions of non-aviation users of GPS.

The Commission’s proposal to extend to this proceeding a case specific recommendation from NTIA that is substantively ill-suited for such an extension ignores the operational reality in which GPS currently exists. It encourages the proliferation of other services or devices without requiring the essential advance studies of the operational consequences for GPS users (thereby ignoring the central issue of the impact on the aggregate noise floor in the

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<sup>18</sup> *Id.* at 9-11.

<sup>19</sup> See The White House, Office of Science and Technology Policy, National Security Council, Fact Sheet: U.S. Global Positioning Systems Policy, March 29, 1996, Pages 1-3 (Reference: Presidential Decision Directive NSTC-6). This commitment, “addressing a *broad range* of military, civil, commercial, and scientific interests, both national and international” was announced in a Presidential Decision Directive (“PDD”) of March 29, 1996. Congress endorsed this commitment in statute with the Defense Authorization Act of 1998 (“PL 105-85”) that was signed into law by the President.

<sup>20</sup> See *NPRM*, FCC 99-97, slip op. at ¶ 68 n. 120 (“The GNSS is a satellite system that provides worldwide position determination, time, and velocity capabilities for multi-modal use. As currently envisioned, the GNSS will encompass aviation, maritime, and terrestrial use.”) (emphasis added).

GPS frequency band), and it ignores the fundamental reality that attempting to limit the interference at the GPS receiver is not possible with the GPS architecture. Once the damage has occurred, historical experience shows that it is difficult if not impossible to “unring the bell” by removing the harmful interference sources. There are no practical remedies other than limiting the noise at the emitter; changes to the established GPS architecture are not possible.<sup>21</sup>

The Commission must begin to recognize that a piecemeal approach to the required protection of GPS from OOB is not sufficient. With every additional type of emission that is permitted into the GPS band, whether one that is reduced to very low levels or one that would produce relatively higher emission levels, the pressure on the GPS noise floor increases. At some point in the not too distant future, some proposed service or emitter type, even if relatively benign to GPS in isolation, will come along and occupy the role of the proverbial straw that broke the camel’s back. In other words, the new emitter would, in conjunction with all existing assaults on the GPS noise floor, have a deleterious impact on the utility of GPS.

The Council is not asserting that 776-794 MHz band emitters such as the ones proposed for operation in the *NPRM* – especially if OOB is limited to –100 dBW/MHz in the GPS band – are that “killer” application. Rather, the Council is pointing out that the Commission needs to take a “bigger picture” perspective when it comes to protecting GPS and maximizing the utility of emitters from other services that may seek to produce even suitably-constrained OOB into the GPS band. A proper frequency management policy is one that does not place on the victim service (RNSS in this case) the full brunt of the obligation to evaluate the interference

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<sup>21</sup> The latter would involve creating and funding a new space system, finding a new global spectrum allocation in already allocated international spectrum environment, worldwide recertification for aviation safety, and replacing millions of receivers owned by government and industry worldwide – options that are clearly not possible in today’s complex domestic and international technical and political environments.

implications of every potential producer of OOB into the GPS bands; rather, a proper policy is one where the Commission requires such emitters to demonstrate up front how GPS will be protected from OOB, and addresses the interaction of the proposed emitter with existing and authorized emitters of OOB into the GPS bands.

### **III. CONCLUSION**

At this time, the only OOB level that can safely be adopted for emitters in the 776-794 MHz band that are under consideration in this rulemaking proceeding is -100 dBW/MHz.<sup>22</sup> For the Commission even to begin to consider an OOB level higher than -100 dBW/MHz for emitters in the 776-794 MHz bands, studies that consider the particular operational characteristics, aggregate interference levels, the impact of harmonic emissions, separation distances, and shielding associated with such emitters must be completed and submitted for consideration. Clearly, these studies, in which the Council stands prepared to provide appropriate assistance and cooperation, have not yet been done.

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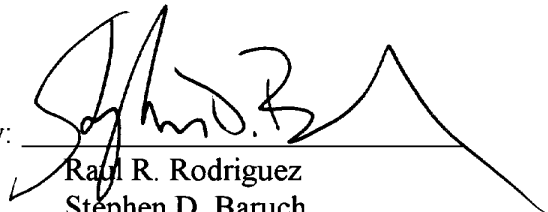
<sup>22</sup> To be sure, the symbiotic, complementary relationship that exists between GPS and MSS mobile earth terminals in the 1-3 GHz bands does not exist with respect to the emitters that would operate in the 776-794 MHz bands.



As a result, and on the basis of the views expressed and showings made by the Council in response to the *GMPCS MoU NPRM* and above, the Council urges the Commission to reject the out-of-band emission provisions it has proposed with respect to the 1559-1610 MHz band in this proceeding.

Respectfully submitted,

THE U.S. GPS INDUSTRY COUNCIL

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July 19, 1999

Its Attorneys

**ATTACHMENT**

**RETURN**

**BEFORE THE  
Federal Communications Commission  
WASHINGTON, D.C. 20554**

In the Matter of )

Amendment of Parts 2 and 25 to Implement )  
the Global Mobile Personal Communications )  
by Satellite ("GMPCS") Memorandum of )  
Understanding and Arrangements )

IB Docket No. 99-67

Petition of the National Telecommunications and )  
Information Administration to Amend Part 25 )  
of the Commission's Rules to Establish Emissions )  
Limits for Mobile and Portable Earth Stations )  
Operating in the 1610-1660.5 MHz Band )

RM No. 9165

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To: The Commission

**COMMENTS OF THE U.S. GPS INDUSTRY COUNCIL**

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## SUMMARY

The U.S. GPS Industry Council (“the Council”), by its attorneys, hereby comments on the Commission’s notice of proposed rule making (“*NPRM*”) in the above-captioned proceeding. The Commission’s *NPRM* proposes limitation on out-of-band emissions (“OOBE”) into the 1559-1605 MHz band from mobile earth terminals (“METs”) associated with mobile-satellite service (“MSS”) systems that operate or are to operate in the 1-3 GHz frequency range. The 1559-1605 MHz band is used by radionavigation-satellite service (“RNSS”) systems such as the U.S. Global Positioning System (“GPS”), which has millions of users worldwide in a wide variety of safety and non-safety related applications.

In these Comments, the Council explains why the  $-70$  dBW/MHz OOBE level that the Commission proposes as a “final,” post-2004 wideband OOBE limit for the 1559-1605 MHz band has been shown to be appropriate only as applicable to OOBE from METs operating with 1-3 GHz MSS systems (due to complementarities between GPS and such MSS operators, and the necessary operational relationship that exists in these limited cases). The Council goes on to explain that, in the absence of specific studies that address critical subjects including the particular operational characteristics, interservice and intraservice aggregate interference levels, the impact of harmonic emissions, separation distances, and shielding, the  $-70$  dBW/MHz level on wideband OOBE into the GPS band cannot rationally be extended to any other types of emitters, regardless of where in the frequency spectrum such emitters may be located.

The Council provides, for the first time, technical studies showing the impact that operation of even a single emitter at a  $-70$  dBW/MHz OOBE level in the GPS band would have

on GPS receivers of the types in use today. Using a target standard of “co-location” of the noise source and the GPS receiver, which standard generously called for operation of the noise source at a distance of up to one meter from the GPS receiver, results showed that at the  $-70$  dBW/MHz level, not one tested receiver would be able to obtain a position fix from GPS satellites. Indeed, receivers started losing the ability to track GPS satellites at distances on the order of 90 feet from the noise source. The Council’s test show that only after the noise source was limited to a level of  $-100$  dBW/MHz would the co-location standard be able to be met. As was to be expected, adding multiple emitters significantly exacerbated the interference threat.

The bottom line from the tests is that the  $-70$  dBW/MHz level is clearly not a protection criterion for GPS. As a result, the Commission must clearly state that the  $-70$  dBW/MHz OOB level for 1-3 GHz MSS METs cannot be extended to any other service without independent study and verification of suitability. To the extent that it may be desirable for the Commission to adopt a “default” OOB threshold level at which emitters other than 1-3 GHz MSS METs would be able to operate without undergoing independent study, the threshold needs to be based on a co-location standard (*i.e.*, the noise source would be one meter or less from the GPS receiver) due to the ubiquity of GPS use. Under this circumstance, the maximum appropriate level for this OOB threshold in the 1559-1605 MHz band is  $-100$  dBW/MHz.

Recognizing that the  $-70$  dBW/MHz level for 1-3 GHz MSS METs is made acceptable only by the complementary relationship between the affected services and that an operational solution must be found, it is emphatically clear that the Commission’s proposal that “Big LEO” MSS earth terminals that are placed in service before 2002 may meet, until January 1, 2005, an interim limit of  $-64$  dBW/MHz on wideband emissions in the band 1580.42-1605 MHz and an

interim limit of -74 dBW on narrowband emissions in the band 1585.42-1605 MHz, must be rejected. If -70 dBW/MHz were the maximum allowable emissions standard, there clearly would be interference from emitters that operate in the same bands at levels greater than -70 dBW/MHz. There is no rational basis either for allowing a higher interim interference level or for limiting the bands within which protection from wideband OOB is provided to a band that does not reflect today's GPS operations.

With respect to the appropriate OOB levels for emitters other than 1-3 GHz MSS METs, the Council urges the Commission to adopt OOB levels for particular emitters on a case-by-case basis, where specific, credible studies have been conducted considering all the relevant factors. To the extent that it may be desirable for the Commission to adopt a "default" OOB threshold level at which emitters other than 1-3 GHz MSS METs would be able to provide OOB into the GPS band (fully 1559-1605 MHz) without undergoing independent study, the threshold needs to be based on a co-location standard (*i.e.*, the noise source would be one meter or less from the GPS receiver) due to the ubiquity of GPS use. Under this circumstance, the Council's data reveal that the appropriate level for this OOB threshold in the 1559-1605 MHz band is -100 dBW/MHz.

Only by embracing the essential qualifications the Council seeks in these Comments, can the Commission adopt OOB limitations and associated policy decisions that both satisfy its obligation to ensure the protection of all uses of GPS and advance its objective of facilitating the establishment of a successful and competitive 1-3 GHz MSS industry.

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To: The Commission

**COMMENTS OF THE U.S. GPS INDUSTRY COUNCIL**

The U.S. GPS Industry Council ("the Council"), by its attorneys and pursuant to Sections 1.415 and 1.419 of the Commission's rules,<sup>1</sup> hereby comments on the Commission's notice of proposed rule making in the above-captioned proceeding.<sup>2</sup> In a gesture of goodwill and the spirit of compromise, the Council earlier this year led the drive to establish, as a position of the United States in the study groups of the International Telecommunication Union ("ITU"), an out-of-band emission limitation of -70 dBW/MHz in the band 1559-1605 MHz for wideband

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<sup>1</sup> 47 C.F.R. §§ 1.415 and 1.419.

<sup>2</sup> See Amendment of Parts 2 and 25 to Implement the Global Mobile Personal Communications by Satellite ("GMPCS") Memorandum of Understanding and Arrangements; Petition of the National Telecommunications and Information Administration to Amend Part 25 of the Commission's Rules to Establish Emissions Limits for Mobile and Portable Earth Station Operating in the 1610-1660.5 MHz Band, IB Docket No. 99-67 (RM No. 9165) (FCC 99-37) (released March 5, 1999) ("NPRM").

emissions from mobile-satellite service ("MSS") earth terminals operating in the frequency bands 1610-1660.5 MHz.<sup>3</sup> Although the -70 dBW/MHz limitation would not protect radionavigation satellite service ("RNSS") receivers operating at 1559-1605 MHz in many of the applications (safety of life and otherwise) for which they are used, the Council recognized that there is a complementary relationship between the RNSS and 1-3 GHz MSS that provides MSS operators with the necessary incentives to ensure that their associated earth terminals are operated in a way that protects RNSS receivers from harmful interference.<sup>4</sup> As a result, the Council and the United States were prepared to accept the -70 dBW/MHz limitation on out-of-band emission levels produced by 1-3 GHz band MSS earth terminals. At the same time, however, the Council and the United States made it very clear that the -70 dBW/MHz limitation (which is reflected in ITU Radiocommunication Assembly ("ITU-R") Recommendation M.1343) may not be applied to any emitters other than MSS mobile earth terminals ("METs") associated with MSS systems in the 1-3 GHz range unless studies have been successfully completed that address critical subjects including interservice and intraservice aggregate interference levels, the impact of harmonic emissions, separation distances, and shielding.<sup>5</sup>

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<sup>3</sup> See ITU Document 8D/210 (4 March 1999), a contribution of the United States to ITU-R Working Party 8D.

<sup>4</sup> Specifically, as noted in Document 8D/210, MSS systems use RNSS (in particular, the U.S. RNSS system known as the Global Positioning System or GPS) for position determination, timing, and other system functions.

<sup>5</sup> See ITU-R Document 8D/210, at 2. This position was reflected in output materials (including a preliminary draft new recommendation on technical characteristics for MSS mobile earth terminals that would operate in the band 1626.5-1660.5 MHz) from the April 1999 meeting of Working Party 8D.

The Council reaffirms its adherence to the position taken by the United States in ITU-R Working Party 8D on the  $-70$  dBW/MHz issue. This was a very constructive compromise that stands to permit the removal of a cloud that has been looming over both the Global Positioning System ("GPS") and MSS operations for some time now. Unfortunately, the Commission's *NPRM* does not correlate well with the more subtle and advanced position that has developed on this issue over the last two years, and thus represents a large and dangerous step in the wrong direction. The Commission's proposals, if implemented, would eviscerate GPS and endanger countless lives and livelihoods in the process. The proposals simply cannot be adopted in their present form. Instead, the Commission should expressly embrace the compromise solution struck earlier this year and adopt rules and policies that bring that solution into permanent effect.

## **I. INTRODUCTION**

In its *NPRM*, the Commission proposes, among other things, to adopt out-of-band emission limits for Global Mobile Personal Communications by Satellite ("GMPCS") earth terminals transmitting in the MSS bands 1610-1660.5 MHz in order to protect the reception of aeronautical RNSS signals in the 1559-1605 MHz band.<sup>6</sup> Specifically, the Commission proposes to require MSS earth terminals that are placed in service on or after January 1, 2002 in the bands 1610-1660.5 MHz to suppress the e.i.r.p. density of wideband emissions to  $-70$  dBW/MHz or less in the band 1559-1605 MHz and to suppress the e.i.r.p. of discrete emissions of less than 700

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<sup>6</sup> *NPRM*, FCC 99-37, slip op. at 4 (¶ 5).

Hz bandwidth (i.e., narrowband emissions) to -80 dBW in the same band.<sup>7</sup> The Commission further proposes that, as of January 1, 2005, the limits on both wideband and narrowband emissions in the 1559-1605 MHz band would also apply to MSS terminals transmitting on frequencies between 1610 and 1660.5 MHz that are placed in service *before* 2002.<sup>8</sup> In the interim – i.e., prior to January 1, 2005 – MSS METs terminals placed in service before January 1, 2002 in the band 1626.5-1660.5 MHz would have to meet the -70 dBW/MHz limit on emissions in the band 1559-1580.42 MHz and would have to meet the -80 dBW/MHz narrowband limit on emissions in the band 1559-1585.42 MHz.<sup>9</sup> Finally, the Commission proposes that “Big LEO” MSS earth terminals (i.e., MSS transmitting earth terminals operating with non-geostationary MSS systems on assigned frequencies in the band 1610-1626.5 MHz) that are placed in service before 2002 may, until January 1, 2005, meet an interim limit of -64 dBW/MHz on wideband emissions in the band 1580.42-1605 MHz and an interim limit of -74 dBW on narrowband emissions in the band 1585.42-1605 MHz.<sup>10</sup>

The Commission states that its proposals are based on recommendations made by the National Telecommunications and Information Administration (“NTIA”) in a September 1997 petition for rule making that is now part of this proceeding.<sup>11</sup> That fact is directly

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<sup>7</sup> *Id.* at 27 (¶ 62).

<sup>8</sup> *Id.*

<sup>9</sup> *Id.*

<sup>10</sup> *Id.*

<sup>11</sup> *Id.* at 26 (¶ 61).

responsible for the principal shortcoming of the *NPRM*, in that the NTIA petition was focused exclusively on “approach, landing and surface operations” of aircraft.<sup>12</sup>

As the Council demonstrates below, the Commission’s proposal will result in harmful interference to GPS, the U.S. RNSS system and the U.S. component of the Global Navigation Satellite System (“GNSS”), provides critical navigation and safety of life services – aeronautical, maritime, and land-based – to millions of users around the world using, *inter alia*, the 1559-1610 MHz frequency band.<sup>13</sup> The final (*i.e.*, post 2005) out-of-band emission (“OOBE”) levels proposed by NTIA were developed for a very specific interference scenario -- *i.e.*, where there was a 100 foot separation between the GPS receiver and the MSS terminal; where the GPS antenna was located on the top of an airplane fuselage and pointed up toward the satellites; and where the MSS terminal is a single, ground-based, omnidirectional transmitter.<sup>14</sup> The NTIA OOBE levels were not intended to be applied for the protection of GPS receivers used in non-aeronautical scenarios or even in other aeronautical scenarios, and there is no proof

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<sup>12</sup> Petition of the National Telecommunications and Information Administration to Amend Part 25 of the Commission’s Rules to Establish Emissions Limits for Mobile and Portable Earth Stations Operating in the 1610-1660.5 MHz Band, RM-9165 (page 1 of enclosure) (filed September 1997) (“NTIA Petition for Rule Making”).

<sup>13</sup> A September 1998 Report issued by the International Trade Administration, Office of Telecommunications, and Department of Commerce, reported an estimated commercial installed base of more than 3 million GPS users, and worldwide production of 250,000 GPS units each month. By the year 2000, the GPS user community was expected to be adding 2 million users per month. *See Global Positioning System, Market Projections and Trends in the Newest Global Information Utility*, at 26-27.

<sup>14</sup> *See* “Assessment of Radio Frequency Interference Relevant to the GNSS,” Document No. RTCA/DO-235 (January 27, 1997).

whatsoever that the NTIA criteria are effective in situations where all three of the conditions above do not exist. In fact, the Council shows here that the proposed levels do not protect GPS receivers (many of which are used in public safety RNSS applications) that are operated in close proximity to GMPCS MSS terminals. Continuity is an operational requirement for a broad range of commercial and public safety users of GPS. Close proximity interference to GPS receivers at any of the levels proposed in the *NPRM* would end the continuous availability of GPS.

GPS receivers are used in ambulances, police cars, fire engines, for harbor-harbor entrance navigation, search and rescue, and docking of large marine vessels, such as oil tankers and high-speed ferries. These applications share the public safety mandate that applies to aircraft operations<sup>15</sup> – the GNSS signals must be continuously available without disruption due to interference. Unlike GPS receivers located on landing aircraft, however, these receivers are likely to be operated in close proximity to or even on a co-location basis with MSS mobile earth terminals. In other words, none of the three conditions under which the OOB levels proposed by NTIA and the Commission would “protect” GPS are present.

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<sup>15</sup> To the extent that the Commission focuses its inquiry in the *NPRM* almost exclusively on aeronautical radionavigation-related requirements, and either tacitly presumes that what is sufficient to protect GNSS would protect all other uses of GPS or ignores the broader safety-related applications of GPS altogether, the *NPRM* suffers from a glaring defect. There is no discernable rational basis for an OOB limitation on MSS METs that is designed only to prevent interference with aircraft reception of satellite radionavigation signals in the 1559-1605 MHz band. See FCC 99-37, slip op. at 19 (¶ 44). There are millions of non-aeronautical, public safety users of GPS that must be accounted for as well.

As indicated above, the Council is prepared, due to the significant incentives that both the MSS and the RNSS industries have to ensure their respective abilities to operate in the adjacent RNSS/MSS bands at around 1.6 GHz, to accept the  $-70$  dBW/MHz OOB limit in the band 1559-1605 MHz for MSS mobile earth terminals operating in the 1610-1660.5 MHz band. This position represents substantial risk for GPS, but the integrity of the Commission's rules for the Big LEO MSS service and associated provisions serve to keep the risk within tolerable levels. Nevertheless, and for all the reasons that are provided below, the Commission must carefully reevaluate the proposals it has presented in the *NPRM*. Under no circumstance can the Commission adopt:

- any provision that would permit at any time a wideband OOB level greater than  $-70$  dBW/MHz in the 1559-1605 MHz band from MSS mobile earth terminals operating in the 1610-1660.5 MHz band; or
- any provision or policy that does not expressly establish that the  $-70$  dBW/MHz OOB limitation suggested here for the 1559-1605 MHz band is limited exclusively to MSS mobile earth terminals operating in the 1610-1660.5 MHz band.

With regard to the second bullet above, the Council observes that other emitters (even other MSS mobile earth terminals in bands outside the 1-3 GHz range) do not necessarily share the incentives for mutual operation that are present for the 1-3 GHz MSS services. In each such case, the Commission must insist that any limits on OOB into the 1559-1605 MHz band be ascertained on a case-by-case basis following credible independent studies of all relevant factors (including interservice and intraservice aggregate interference levels, and the impact of harmonic emissions, separation distances, and shielding). In other words, the Commission must clearly rule that the  $-70$  dBW/MHz OOB level is not a protection criterion for GPS, nor is it a

level to be applied by default to any service other than the 1-3 GHz MSS METs in lieu of separate study.

In short, any Commission determination in this or any other proceeding that does not include all of the factors just outlined would jeopardize the GPS system and the millions of users worldwide who are relying on its continuous availability.

## **II. STATEMENT OF INTEREST**

The U.S. GPS industry Council is a non-profit 501(c)(6) industry trade association whose mission is to be an information resource to the Government, the media, and the public on GPS. The Council's purpose is to promote sound policies for the development of commercial markets in civilian application, while preserving the military advantages of GPS. Current membership includes the principal U.S. manufacturers of GPS equipment – *e.g.*, Boeing, Honeywell, Magellan/Ashtech, Rockwell International, and Trimble Navigation.

The Council represents a significant sampling of the hundreds of manufacturers of GPS equipment and the millions of users of GPS signals. On behalf of its members, many of whom are engaged in activities with safety-of-life implications, the Council is extremely concerned that if the Commission were to adopt its proposed emission standards without considering all the operational and technical variations, it would lead to the loss of GPS signal reception or errors in position or time accuracy. Either of these consequences is intolerable for a safety-of-life service.



### III. DISCUSSION

A. **The Commission's OOB Proposal Must Be Considered In Light Of The Strong, Congressionally-Dictated Commitment Of The United States To The GPS System.**

The U.S. has made an unequivocal and strong commitment to the "continuous availability of GPS." This commitment, "addressing a *broad range* of military, civil, commercial, and scientific interests, both national and international" was announced in a Presidential Decision Directive ("PDD") of March 29, 1996.<sup>16</sup> Congress endorsed this commitment in statute with the Defense Authorization Act of 1998 ("PL 105-85") that was signed into law by the President.

PL 105-85 further provides that "[t]he Secretary of Defense shall provide for the sustainment and operation of the GPS Standard Positioning Service for peaceful, *civil, commercial, and scientific uses* on a continuous worldwide basis". GPS has never been defined, or limited to, an aeronautical service only. To treat it as such for purposes of frequency management is contrary to the letter and intent of Presidential policy and public law. Consequently, this *NPRM* provides an important regulatory opportunity to faithfully carry out the intent of law and policy to protect the broad range of millions of non-aviation users of GPS. In any event, the regulations cannot be limited to aeronautical purposes only.

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<sup>16</sup> See The White House, Office of Science and Technology Policy, National Security Council, Fact Sheet: U.S. Global Positioning Systems Policy, March 29, 1996, Pages 1-3 (Reference: Presidential Decision Directive NSTC-6).

The Commission's proposal to adopt a "one size fits all" regulatory standard creates three problems: 1) it ignores the operational reality in which GPS already exists; 2) it invites the proliferation of other services or devices, without requiring the essential advance studies of the operational consequences for GPS users, and thereby ignores the central issue of the impact on the aggregate noise floor in the GPS frequency band; and 3) it ignores the fundamental reality that attempting to limit the interference at the GPS receiver is not possible with the GPS architecture. Once the damage has occurred, historical experience shows that it is difficult to impossible to "clean the band" by removing the harmful interference sources. There are no practical remedies other than limiting the noise at the emitter; changes to the established GPS architecture are not possible. This would involve creating and funding a new space system, finding a new global spectrum allocation in already allocated international spectrum environment, worldwide recertification for aviation safety, and replacing millions of receivers owned by government and industry worldwide – options that are clearly not possible in today's complex domestic and international technical and political environments.

Congress further directed the Administration to "protect the integrity of the Global Positioning System frequency spectrum against interference and disruption" in the Defense FY99 Appropriations Conference Report and in the Commercial Space Act of 1998.<sup>17</sup> All users of GPS rightfully rely on these commitments, as do makers of GPS equipment for public safety, commercial, and infrastructure applications. Unless the specific protection

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<sup>17</sup> H.R. 105-746, Defense FY99 Appropriations Conference Report; H.R. 1702 Commercial Space Act of 1998.

measures the Council details in these Comments are taken by the Commission, the proposals in the NPRM will undercut these commitments and fatally compromise the integrity of the GPS system.

**B. Results Of Studies Show That The Operation Of 1-3 GHz MSS Mobile Earth Terminals At OOB Levels Of -70 dBW/MHz Or Higher Would Cause Substantial Interference To GPS Receivers In Many Applications (Both Safety Of Life And Otherwise) In The 1559-1605 MHz Band.**

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Stating that it is acting in accordance with the NTIA Petition for Rule Making, the Commission has proposed to require MSS earth terminals that are placed in service on or after January 1, 2002 in the bands 1610-1660.5 MHz to suppress the e.i.r.p. density of wideband emissions to -70 dBW/MHz or less in the band 1559-1605 MHz and to suppress the e.i.r.p. of discrete emissions of less than 700 Hz bandwidth (i.e., narrowband emissions) to -80 dBW in the same band.<sup>18</sup> For the period prior to January 1, 2005, the Commission proposes that MSS earth terminals that were placed in service in the band 1626.5-1660.5 MHz before January 1, 2002 would have to meet the -70 dBW/MHz limit on emissions in the band 1559-1580.42 MHz and to meet the -80 dBW/MHz narrowband limit on emissions in the band 1559-1585.42 MHz.<sup>19</sup> Finally, the Commission proposes that "Big LEO" MSS earth terminals (*i.e.*, MSS transmitting earth terminals operating with non-geostationary MSS systems on assigned frequencies in the band 1610-1626.5 MHz) that are placed in service before 2002 may, until January 1, 2005, meet

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<sup>18</sup> NPRM, FCC 99-37, slip op. at 27 (¶ 62).

<sup>19</sup> *Id.*

an interim limit of  $-64$  dBW/MHz on wideband emissions in the band 1580.42-1605 MHz and an interim limit of  $-74$  dBW on narrowband emissions in the band 1585.42-1605 MHz.<sup>20</sup>

As an initial matter, the Council notes that even if it could be hypothesized for sake of argument that the  $-70$  dBW/MHz OOB specification that has been recommended by NTIA would provide sufficient protection for GPS receivers – and the Council shows below why it cannot – there is no rational basis either for allowing a higher interference level before January 1, 2002 or for limiting the bands within which protection from wideband OOB is provided to a band that does not reflect today's GPS operations. If  $-70$  dBW/MHz were the maximum allowable emissions standard, there clearly would be interference from emitters that operate in the same bands at levels greater than  $-70$  dBW/MHz. Moreover, many classes of GPS receivers in commercial and civil use employ the system's "Y" code, which extends to 1585.65 MHz at its upper end – *i.e.*, 10.23 MHz from the GPS center frequency of 1575.42 MHz. Any standard, interim or permanent, that does not limit both wideband and narrowband OOB at least in the band extending  $\pm 10.23$  MHz from 1575.42 (*i.e.*, from 1565.19 MHz to 1585.65 MHz) is, by definition, irrational.

The Commission must ensure that the GPS public safety applications are always protected. There is simply no room for interim emissions standards that pose an even greater interference threat to GPS than that which is represented by MSS METs operating or to be operated in the 1610-1660.5 MHz band (and for which the Council has accepted that operational considerations are envisioned to compensate for the inadequacies of the  $-70$  dBW/MHz OOB

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level). Therefore, and in addition to all of the other recommendations the Council advances below, under no circumstance can the Commission adopt any provision that would permit a wideband OOB level greater than  $-70$  dBW/MHz from any emitter (MSS METs or otherwise) at any time.

The Council has long maintained, in various Commission proceedings, that the  $-70$  dBW/MHz OOB level is inadequate to ensure the protection of GPS receivers.<sup>21</sup> By “protection,” the Council is referring to a level of OOB at which GPS receivers that are already tracking the system’s satellites remain able to do so, and at which those GPS receivers that are attempting to acquire signals from GPS satellites are able to do so.

Until now, much of what the Council has argued has been based on preliminary internal test results and, for lack of a better term, logic. The ability to do empirical testing has been hampered by the commercial unavailability of emitters (namely Big LEO METs) that would operate at or near the  $-70$  dBW/MHz OOB level in the GPS L1 band (*i.e.*, 1555-1610 MHz). The Council was not prepared to rely for such an evaluation on simulations that did not at least approach real world operating conditions. The “logical” element of the Council’s contentions stems from the realization that an OOB standard that was based on protecting GPS

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*See id.*

receivers that operate under three very specific conditions (see page 5, *supra*) cannot logically be presumed – without more – to provide protection to those same receivers in any situation where all three of these conditions are not met.

Over the last several months, the Council has been conducting a series of tests on OOBE in the GPS band under conditions that it believes reliably replicate real-world conditions. In this respect, the tests performed have been kept as simple and straightforward as they can be and still retain scientific validity, in order to be readily comprehended by as broad a cross-section of interested user groups as possible. Furthermore, the tests were not designed to produce a skewed, “worst-case” set of results, but instead to produce results that are objectively representative of what actual GPS users would experience and understand.

The test program, methodology, and results are presented in Attachment 1 to these Comments. The principal goal of the Council’s test program was to determine the susceptibility of a variety of RNSS receivers to the effects of interference from a white noise test source radiating from a near-isotropic antenna with an effective isotropic radiated power (“EIRP”) of –70 dBW/MHz into the RNSS bands in situations likely to be encountered in non-aviation

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<sup>21</sup> See, e.g., U.S. GPS Industry Council Petition to Deny AirTouch Satellite Services US, Inc., Application for Blanket Authorization to Construct and Operate Mobile Satellite Earth Terminals (“METs”) in File No. 1367-DSE-P/L-97, at 10-11 (filed June 19, 1998); Petition for Reconsideration Regarding the Application of U.S. Leo Services, Inc. for Consent to the Assignment of a Blanket Earth Station License to Iridium U.S., L.P., in File No. 1044-DSE-AL-98, at 3-4 (filed August 31, 1998); Comments of the U.S. GPS Industry Council on the Commission’s Proposal to Adopt Procedures for the Certification of Ground Segment Equipment for Use in the Provision of Global Mobile Personal Communications Services by Satellite (“GMPCS”), GEN Docket No. 98-68, at 6-7 (filed July 27, 1998).

operational settings (such as those where GPS receivers and the subject emitters are co-located in vehicles or boats using GPS for navigation). The following questions were examined:

- At what distance from the noise source does an RNSS receiver start to experience an impairment, such as the onset of loss of ability to track one satellite?
- At what distance from the noise source does an RNSS receiver recover the ability to track all of the satellites originally available?

Tests were conducted employing five different civil, commercial, and military GPS receivers from multiple manufacturers. At an OOB level of  $-70$  dBW/MHz in the RNSS band, receivers lost tracking on the first GPS satellite at a distance of more than 20 meters (65 feet) on the high end, and a distance of 2 meters (6.5 feet) or so on the low end. The distance at which the receivers were able to reacquire all of the originally available satellites ranged from about 7 meters (23 feet) on the lower end to 19 meters (63 feet) on the upper end. The bottom line: under a virtual co-location situation, where the GPS receiver is one meter or less from the noise source, an OOB level of  $-70$  dBW/MHz completely prevented the studies receivers from tracking and securing position fixes from GPS satellites.<sup>22</sup>

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<sup>22</sup> The practical impact of the test data is reflected in the following examples:

- Wideband receivers (centimeter accuracy) are affected. In two cases, two different receivers experienced a loss of tracking of the first satellite at 12 meters separation from the test source. Survey receivers are representative of the type of GPS receivers being used in machine control and mining operations. 12 meters means that construction crews on highways traveled by users of MES handsets or other sources of equivalent noise output will be affected.
- In-vehicle navigation systems are severely affected at 4 meters (13 feet). It is easy to envision adjacent automobiles in which an interfering source in one vehicle is travelling near enough to another vehicle that the second vehicle's navigation system would be rendered useless.